Translation

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Form PCT/IPEA/416
WA-0926		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/JP2004/009653	07.07.2004	07.07.2003

International Patent Classification (IPC) or national classification and IPC

C08F36/06, 8/08, C09K5/02, G05D23/275, H01H37/46, 37/52

Applicant

UBE INDUSTRIES, LTD.

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 10 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 2 sheets, as follows:

      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))

      _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☒	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
Name and mailing address of the IPEA/JP Facsimile No.	Authorized officer Telephone No.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/JP2004/009653

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following _____, which is the language of a translation furnished for the purposes of:

☐ international search (Rule 12.3 and 23.1(b))

☐ publication of the international application (Rule 12.4)

☐ international preliminary examination (Rule 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1-22 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

nos. 3, 7, 10, 12-14, 16, 18 as originally filed/furnished

nos.* _____ as amended (together with any statement) under Article 19

nos.* 1, 2, 4-6, 8, 9, 11, 15, 17, 19 received by this Authority on 07.02.2005

nos.* _____ received by this Authority on _____

☒ the drawings:

sheets fig. 1-9 as originally filed/furnished

sheets* _____ received by this Authority on _____

sheets* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/JP2004/009653

Box No. IV **Lack of unity of invention**

1. ☐ In response to the invitation to restrict or pay additional fees the applicant has:
   - ☐ restricted the claims.
   - ☐ paid additional fees.
   - ☐ paid additional fees under protest.
   - ☐ neither restricted the claims nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:
   - ☐ complied with.
   - ☒ not complied with for the following reasons:

   See supplemental box.

4. Consequently, this report has been established in respect of the following parts of the international application:
   - ☒ all parts.
   - ☐ the parts relating to claims Nos. _____

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/JP2004/009653

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-19	YES
	Claims		NO
Inventive step (IS)	Claims	1-6, 9, 11, 15, 17-19	YES
	Claims	7, 8, 10, 12-14, 16	NO
Industrial applicability (IA)	Claims	1-19	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

This international preliminary examination report was prepared with reference to the following documents 1 to 6.

Document 1: JP 2001-213917 A

Document 2: WO 2001/57889 A1

Document 3: JP 49-60256 U

Document 4: JP 2002-124172 A

Document 5: JP 38-22230 Y1

Document 6: JP 9-268208 A

Claims 7, 8, 10, 12, and 13

Claims 7, 8, 10, 12, and 13 do not involve an inventive step in the light of documents 2 to 4.

Document 2 discloses a feature wherein the volume of a polybutadiene having a trans-1,4 bond content of at least 85% increases rapidly when heated due to crystal transition.

Document 3 discloses the manufacture of a switch by laminating a synthetic resin member having a high coefficient of linear expansion when heated and a metallic member having a low coefficient of linear expansion, wherein said switch uses the mechanical force

arising from the difference between the two coefficients of linear expansion.

Document 4 discloses an anti-overheating device having a switch that uses the recoil action of a bimetal plate (a laminated plate comprising two metals having different coefficients of linear expansion).

A person skilled in the art could easily conceive of manufacturing a thermally actuated plate by laminating the trans-1,4-polybutadiene that expands rapidly in volume when heated due to crystal transition, disclosed in document 2, with a substrate having a coefficient of linear expansion that is smaller than that of the above polybutadiene. Further, a person skilled in the art could easily conceive of using the resulting thermally actuated plate as an anti-overheating element.

Meanwhile, in the response to the written opinion, the applicant asserts that the use of a resin exhibiting rapid change in volume only within a specified temperature range clearly involves an inventive step, but claims 7, 8, 10, 12, and 13 do not stipulate the use of such a resin, and therefore, the applicant's argument cannot be accepted.

Claims 14 and 16

Claims 14 and 16 do not involve an inventive step in the light of document 2 and document 5.

Document 5 discloses a thermally actuated switch wherein electrically conductive metal wiring and an organic material having a large coefficient of linear expansion are disposed between a pair of electrodes, and the connection is opened and closed using the difference

between the coefficients of linear expansion for the organic material and the metal wiring.

A person skilled in the art could easily conceive of using the trans-1,4-polybutadiene that expands rapidly in volume when heated due to crystal transition, disclosed in document 2, as the organic material having a large coefficient of linear expansion disclosed in document 5.

Claims 1 to 6, 9, 11, 15, and 17 to 19

Claims 1 to 6, 9, 11, 15, and 17 to 19 are novel, involve an inventive step, and are industrially applicable.

Documents 2 to 5 neither disclose nor suggest the features described in claims 1 to 6, 9, 11, 15, and 17 to 19.

Document 1 discloses a trans-1,4-polybutadiene intended for use as a thermal storage material, and in the examples, discloses a polymer for which Ttr is 55.1 to 70.1°C and ΔHtr is 57.9 to 108 J/g, but no polymer satisfying the conditions stipulated in the present claim 1 is disclosed in document 1.

Document 6 also discloses a trans-1,4-polybutadiene intended for use as a thermal storage material, and in example 3, discloses a polymer for which Ttr is 60°C, but no polymer satisfying the conditions stipulated in the present claim 1 is disclosed in document 6.

It is obvious to a person skilled in the art that a thermal storage material that can be used at as low a temperature as possible and which can store a large quantity of heat (in other words, a material having a small Ttr and a large ΔHtr) is preferable, but document 1

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

and document 6 do not specifically disclose how a polymer satisfying the conditions stipulated in the present claim 1 could be manufactured, nor means for such manufacture. Accordingly, claims 1 to 6, 9, 11, 15, and 17 to 19 involve an inventive step.

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claims 1 to 6 claim crystalline polymers which are specified only in terms of physical properties, but the only polymer disclosed in detail in the description as satisfying said physical properties and for which means of regulating said properties are made clear is an epoxy-modified polybutadiene having a trans-1,4 structure content of at least 97 mol%.

Further, the description does not specifically disclose in detail means whereby the physical property conditions defined in claims 1 to 6 can be satisfied when some other polymer is selected.

Therefore, other than an epoxy-modified polybutadiene having a trans-1,4 structure content of at least 97 mol%, the crystalline polymers defined in claims 1 to 6 are not sufficiently supported by the description.

In the response to the written opinion, the applicant asserts that a trans-polybutadiene modified with a functional group sufficiently small enough to be included in the crystal phase can be considered as satisfying the useful physical properties stipulated in claims 1 and 2 of the present application, and that the ΔHtr of trans-polybutadiene can be increased by reducing molecular weight.

However, it is unclear what functional groups other than an epoxy group can be used as "a functional group sufficiently small enough to be included in the crystal phase," and as for unmodified trans-polybutadiene, it is unclear from comparison example 1 what means might be

Box No. VIII Certain observations on the international application

applied in order to satisfy the physical properties defined in claims 1 to 6.

Indeed, it is hardly possible that a person skilled in the art could predict means by which a polybutadiene having a cis-1,4 structure or polymers other than polybutadiene (such as polyolefins) could be made to satisfy the physical properties defined in claims 1 to 6.

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Box IV, 3.

1. Claims 1 to 6, 9, 11, 15, and 17 to 19

The above claims describe inventions of a crystalline polymer exhibiting solid phase reversible crystal transition at 60°C > Ttr > 20°C and satisfying specified conditions for ΔHtr and Ttr, and a thermally actuated plate, thermally actuated switch, thermal storage material, and thermal storage medium using said polymer, and a heating method for said thermal storage material and thermal storage medium.

2. Claims 7, 8, 10, 12, and 13

The above claims describe inventions of a thermally actuated plate and an anti-overheating element comprising said thermally actuated plate, and there is no relationship between said inventions and the above crystalline polymer involving one or more of the same or corresponding special technical features.

3. Claims 14 and 16

The above claims describe an invention of a thermally actuated switch, and there is no relationship between said invention and the above crystalline polymer involving one or more of the same or corresponding special technical features.